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Globalização e Convergência do Desenvolvimento Económico

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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Economia, realizada sob a orientação científica do Doutor Miguel Lopes Batista Viegas, Professor Auxiliar Convidado do Departamento e Economia, Gestão e Engenharia Industrial da Universidade de Aveiro

Dedico este trabalho aos meus pais e irmã por todo o apoio que me deram, não apenas no período relativo à dissertação, mas ao longo de toda a minha vida, bem como aos meus avós, tios e primos que sempre estiveram lá para mim.

o júri

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palavras-chave

Desenvolvimento Económico, Globalização, Desigualdade, Crescimento Económico, Convergência, Capital Humano.

resumo

Globalização é, hoje em dia, um conceito muito em voga, sendo já um assunto de elevada importância e controvérsia há um par de décadas. Neste trabalho vou-me focar mais na conjetura social e a sua relação com a Globalização, em vez de me focar apenas na parte económica.
Este trabalho envolve o estudo de países de diferentes continentes e diferentes situações económicas e sociais, para períodos compreendidos entre 1980 e 2012. Ao longo do trabalho, vários indicadores serão estudados, desde variáveis económicas a variáveis mais relacionadas com a vertente social, com o objetivo de conduzir testes de Convergência, tanto Sigma como Beta (absoluta e condicional).

keywords Economic Development, Globalization, Inequality, Convergence, Human Capital.

abstract Globalization is a very important concept nowadays, and has been, for a couple of decades, a very controversial concept. In this paper I will focus more in the social conjecture of the world and its relationship with Globalization rather than just the economical.
This work concerns countries from different continents different economic and social situations for the period between 1980 and 2012. Throughout the work, several different variables will be studied, from economic variables to more social variables in order to do some Convergence exercises, both sigma and beta (absolute and conditional).

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Introduction

Globalization can be defined as a process of cultural, political, social and economical integration. In this work I will focus more in the social and economical parts of the Globalization process. Globalization as process has been in motion for many years. Some authors consider that its beginning dates back to the discovery of America and the passage of the Cape of Good Hope to the East India (Smith, 1977).

Globalization increases the connectivity and interdependence within the world. This process has been boosted by major advances over the past few decades concerning technology, transportations and communications. There are several different views on Globalization, making it hard to reach a consensus on a definition for it, because it is such a broad and embracing process.

For many people, Globalization is a process that carries enormous positive potential for all of the nations that would take part in it (Onwuka & Eguavoen 2007). It is pretty evident there is a divide on the opinions concerning the effects of Globalization. The question has been raised by many that the way in which Globalization has been conducted might be responsible for it failing the expectations of some.

As such, Globalization can be seen as a force responsible for Economic Growth, prosperity and democratic freedom (Dollar & Kraay, 2004). Other authors though think of it more as the growth of power for developed countries over poorer nations, blaming it for the devastation of nature and the exploitation of developing countries, due to what is seen by some as rash neo-liberalism (Stiglitz, 2003).

Globalization, as a process, sounds exciting and promising, but the way this phenomenon is being dealt with is raising a lot of criticism due to its financial neo-liberalism, deregulation of domestic markets, free trade and open markets (consequently submitted to greater competition). Also the power exerted by powerful countries and corporations that are accused by many to be able to shape the ways of world trade brought many critics to Globalization. Since the increasing problems concerning the environment and sustainability, especially with global warming on the rise and its effects being felt in an unprecedented fashion, there is a lot more pressure on governments.

Globalization brings more opportunities but also more competition to the economies and according to pro-Globalization groups, that competition brings more efficiency and the opportunities brought by Globalization are given to almost everyone. The World Trade Organization (WTO) is a pan governmental entity responsible for setting the rules for global trade and capital flows, as well as supervising its member countries to ensure the rules are being followed, which makes of this pro-Globalization organization a major intervenient in terms of economical and financial importance.

As time went by, Globalization's course has caused a lot of controversy, with the number of people unsatisfied with Globalization rising. As the anti-Globalization movement gained

support and attention from the media, several anti-Globalization groups and organizations were formed, like ATTAC[1] and Environmental groups, International Aid Organizations (Oxfam) as well as third world government organizations (G-77).[2]

These groups defend Globalization brings more inequality as it brings greater wealth and living conditions to some countries, while leading others to a condition of greater misery. Some authors blame this on many developing countries having a lot of problems concerning its management by their governments, as this makes it very hard to deal with the aggressive competition that comes with the openness characteristic of Globalization (Onwuka & Eguavoen, 2007).

Since I will be studying both Economic Development and Economic Growth, it is important to make the distinction between these two concepts, sometimes misleadingly used as synonyms. Economic Growth is a quantitative measure and is usually measured by a country's Gross Domestic Product (GDP). Economic Growth focuses on the increases in the economy's output, referring to an increase in the real output of goods and services in the country, being this way related to a gradual increase in one of the several components of the Gross Domestic Product (consumption, spending, government, investment, net exports). Another drawback of GDP based indexes is the fact that Economic Growth does not take into consideration the activity and size of the parallel economy, composed of all unrecorded economic activity.

Economic Growth is a necessary condition for Economic Development, but the contrary is not true (Anand & Sen, 1994). Therefore, Economic Growth is an indicator extensively used. Economic Development on the other hand is a normative concept that is usually associated with the increase on living standards, quality of life and freedom from oppression (Soubbotina & Sheram, 2000). Economic Development can be measured using indicators like the Human Development Index (HDI), the Gender-related index (GDI), the Human Poverty Index (HPI), infant mortality, literacy rates and many other variables concerning quality of life (Health, Environment and other Social variables) (Jahan, 2001).

As Arcelus et al. (2005) refer, the Human Development Index or HDI, one of the most important and utilized indicators when it comes to measuring Economic Development, has three main dimensions or sub-constructs related to health, education and income, equally weighted when it comes to its calculation by the United Nations Development Programme.

Despite the fact that real wealth has the potential to bring greater human well-being, it is a very imperfect measure of Human Development. As such, HDI becomes a very useful tool when

1 ATTAC or Association for the Taxation of financial Transaction and Aid to Citizens, originated in 1998 under the name Action for a Tobin Tax to Assist the Citizen, was initially a one objective organization that nowadays deals with multiple issues linked to Globalization.

2 The World Social Forum originated in Brazil in 2001, has had meetings annually ever since and tries to attempt and create alternatives to a Globalized future.

compared to GDP when it comes to measure the Economic Development (Human Development Reports - United Nations Development Programme (UNDP) - Human Development Index (HDI)).

Economic Development involves changes in income, saving and investment as well as gradual changes in socio-economic structures, in the form of institutional and technological changes. Unlike Economic Growth, Economic Development brings not only quantitative changes, but also qualitative changes to the economy.

A subject that has for a long time been the cause of investigation is the differences between developed and developing countries, as well as the factors responsible for the clear differences amongst the two groups of countries. Moreover another important point is raised as scholars try to understand if that gap between the countries is disappearing and convergence is indeed in the horizon, or if this hierarchy between countries is permanent.

Convergence, also known as catch-up effect can, economically speaking, be divided into two main types, Sigma-Convergence and Beta-Convergence (Barro & Sala-I-Martin, 1991). The hypothesis of Sigma-Convergence is studied through cross-sectional dispersion of a variable (income or other indicators amongst countries), most usually by standard deviation or through the use of the statistic of coefficient of variation. If the dispersion falls with time, there is Sigma-Convergence.

The other type of Convergence, Beta-Convergence can be divided into two other sub-types, Conditional Beta-Convergence and Absolute Beta-Convergence. In Absolute Beta-Convergence countries all converge to the same steady state, which means that poor countries will always grow faster than richer countries in cases of Absolute Beta-Convergence, without any other conditionings. However, when it comes to Conditional Beta-Convergence, each country converges to its own level of steady state.

When it comes to Globalization there is no consensus among scholars, with some arguing that there has been sigma convergence and some saying there has not been (Akyuz et al. 2002). Whilst some scholars like Rowthorn & Kozul-Wright (1998) say that there is very little empirical evidence suggesting that openness and greater investment leads to developing countries growing faster, other scholars however argue that Globalization leads to growth (Dreher, 2002).

This lack of consensus can also be seen when it comes to the variables used by scholars to check for Convergence. Another point in which there is a lot of controversy concerns the variables that are used when it comes to the study of convergence. Some author use GDP (Rowthorn & Kozul-Wright, 1998) others use other development measures like the GINI coefficient (Monfort, 2008), others choose HDI (Sapkota, 2010).

The main objective I purpose to achieve in this work is to do an exercise of convergence using a database as large as possible, comprehending countries of all four continents for the period between 1986 and 2010. I will repeat this exercise using both classical variables like GDP *per capita* and confront the results with convergence exercises for HDI. Essentially, I will be doing similar convergence exercises for both Economic Growth and Economic Development.

This paper's structure is composed by an Introduction followed by the Literature Review on the subjects in hand. In the third part comes the Methodology and Data. Results are then discussed in the fourth part and finally, in section five the Conclusions are presented.

Literature Review

A very interesting perspective on Globalization is presented by Safdari, Abouie-mehrizi, & Elahi (2011) when they write, “The process of Globalization is both subversive and addictive. It is subversive because it undermines the status quo and challenges vested interests. It is addictive because choice, freedom, knowledge, and greater material gain, once tasted, raise expectations for even more of the same, expectations that are not easily managed politically.”.

Greenwood (2004) refers to the IT (Information Technology) revolution and the rapid and vast embrace of free market policies in the period following the downfall of communism as two of the most important causes for the launching of Globalization as a process of “integration of economies and mixing of cultures over the past decade around the world”.

Yared & Acemoglu (2010), when talking about the political limits of Globalization stress that Globalization is a process that can still be reversed (it is still a choice of every country to keep its borders open and keeping open to trade). The authors point militarism and nationalism as big possible obstacles to this process, as data concerning proxies for both shows both militarism and nationalism are negatively related with trade.

Bairoch & Kozul-Wright (1996) defend, very controversially, that before 1913 there was not much trade liberalization. The authors defend that the rapid industrial growth that certain countries experienced in that era was not due to Globalization. Moreover they argue that the period in question was a period of great Economic Development inequality. This uneven Economic Development shows strong signs of being related with the internationalization of finance capital (characteristic common to the contemporary era of Globalization).

Dolvik (1999) defends that the theory of global convergence is based on four fundamental empirical and theoretical flaws, starting with the idea that Globalization is a far less universal phenomenon then it is widely believed to be. The second point stressed by the author is the fact that Globalization ca not be explained solely by independent and irresistible market forces because these forces are launched by political decisions and are also dependent on institutionalized incentive structures.

Thirdly, according to Dolvik (1999), the theory that defends Globalization as a force responsible for institutional convergence[3] is a way too simplistic and deterministic understanding of the interactions between economic dynamics and social change, markets and politics. Dolvik considers the behavior of markets and social institutions to be interdependent and molded by its interactions. In Dolviks opinion, there is no “universal best way” to organize the economy and no mechanism responsible for making market integration dictate changes in organizational structures, rejecting the hypothesis of institutional convergence.

3 Institutional Convergence refers to the convergence in the ways Institutions run and are organized, usually converging towards the way Institutions in richer, more developed countries are run (Iancu, 2009).

Radice (2000) found empirical proof supporting that Globalization was reducing the differences of the quality of institution and practice across nations. The author also found evidences that Globalization brought changes in the structures and the functioning of capitalism systems in the world.

In their work, Rourke & Williamson (2000) mention the lack of consensus amongst scholars when it comes to the beginning of Globalization. Some scholars point to 1492 and 1498. There is a third group of scholars that say before the 19th Century, the world was still very far from being Globalized and still very broken in terms of interconnectedness. Data suggests that 19th century had a very considerable peak of Globalization, as well as the trade of bulk commodities between continents at cheaper prices. This was particularly due to the falling of monopolies in long distance trade and the advances in technology. Growth in trade had a considerable effect on domestic policies in this period and there was also great political debate present in that century, also, characteristic of Globalization.

According to Trebilcock (2005), the main critique of the anti-globalists is the economical aspect of Globalization, particularly the way the process of international trade and financial liberalization. They blame it for the raising inequalities as well as for the disregard of human rights and environmental concerns. The anti-Globalization movement has also made their discontent pretty clear and public over the past decade, accusing the WTO of being "undemocratic and unaccountable form of global government". Trebilcock (2005) defends the view that Globalization has not been taken to its full extent due to certain barriers to trade as well as trade remedy actions.

Olusi et al. (2006) identify three types of authors when it comes to the view on Globalization. There are the ones who believe it to be a way for poor countries to achieve prosperity and the ones that believe Globalization to be responsible for the increase in the gap between poor and rich countries. Lastly, there is the group of authors that think Globalization could be terrible for some and very good for others if it is not properly handled.

Sachs (2000) says that for the periods between 1870 and 1914 and from 1950 until the essay was written, there is no doubt that Globalization brought greater growth rates globally speaking. Not every country has collected benefits from this process in the same degree though. As Sachs (2000) states, it is clear that Globalization on its own will not lead to convergence, which means that social and economic policies will be of great importance. Also the policies chosen must have the facts mentioned before in consideration, as well as the pattern of development in which each country is inserted. Sachs (2000) describes five different patterns of development, showing how these patterns are related to the underlying geography, economic policies, and resource endowments of the countries. The patterns mentioned above are Endogenous Growth, Catching-up Growth, Resource-based Growth, Malthusian decline and Economic Isolation, a categorization admittedly arbitrary and intentionally simple.

Sapkota (2010) presents a very important argument that, despite being a very important indicator to measure quality of life, income is not the only significant indicator. The other two dimensions of HDI, education and health are just as, if not more important. Income is usually just

the means, whilst education and health are the end goals. Sapkota also agrees that both rich and poor countries should incentivize Globalization, defending that richer countries should opt for an approach of greater openness towards poorer countries, rather than providing them with more aid. The author finds convergence on the Health and Education indicators as well as concluding that Globalization indicators present significant impact on convergence. Sapkota (2010) suggests studying each country individually as to better recommend adequate policies concerning the promotion of Globalization whilst trying to achieve convergence in Human Quality of Life.

Lutz (2001) argues that the potential benefits for developing countries from greater Globalization are usually exaggerated. The author acknowledges that the defendants of greater openness have clearly won the debate over the vantages and disadvantages of greater Globalization in developing countries, thus, making this the most consensual current policy. Svejnar et al. (2008) find that Globalization increases competition, pressure and opportunities for domestic firms. However, competition is found by the authors to have a negative effect on innovation, in countries with emerging markets. Despite that, pressure brought on domestic firms by foreign firms and association with those firms does stimulate innovation according to the findings of Svejnar et al. (2008).

The evidence found by Brady et al. (2001) concludes that only a few indicators of economic Globalization have significant effect on Welfare state. Moreover, the effects of globalization are rather small relative to the effects of domestic politics. Another characteristic of these globalization effects is that they are not always different between European and non-European countries.

Dollar & Kraay (2004) argue that the growth rates of richer countries have slowed down. The same seems to be truth for the economies of developing countries outside the Globalization process, whilst the developing countries that enter in the globalization process are growing faster. Dollar & Kraay (2004) also found support to the theory according to which Globalization brings greater growth and less poverty. Lastly, the author concluded that changes in trade volumes bring positive changes in growth rates.

Williamson & Lindert (2003) argue that, while the world is far more integrated than it was two centuries ago, it is also more unequal. Despite the global effects of Globalization having been too small to explain the growing inequality in the world, between-countries, not so much within-countries. The authors believe it might have helped to shorten the gap between countries that participated in the Globalization process. It is clear that the countries that chose not to take part in the Globalization from the get go fell behind the ones that did.

Jones (2003), on its comment of the work of Dowrick & Delong (2003), says that in the period before World War I, Globalization only brought convergence to a certain group of countries, (the “charmed circle”), from the Western and Middle Europe. However, the author says that another possibility, and the one he believes to be more plausible, is that Globalization, in the time that preceded the first World War has indeed raise the growth rates in every country involved in the process. Despite that, Jones believes it most likely brought greater growth rates to the countries in the “charmed circle”, making the gap between the groups even greater. The

author suggests that the different stages at which different countries were in terms of industrialization, at this point in time might explain the different growth rates carried by Globalization. This means that, if not by the continued industrialization of the countries of the charmed circle, Globalization could actually lead to convergence around the world.

On its work, Williamson (1996) considers three epochs of growth experience after the nineteenth century for the OECD club: The late nineteenth century, the middle years between 1914 and 1950 and the late twentieth century. There is a general consensus throughout time that there is a positive correlation between Globalization and Convergence. However, by examining the pre World War I years, this correlation turns out to be causal, with Globalization turning out to be the key for convergence. Most of the convergence between 1850 and 1914 was due to the open economy forces of trade and mass migration. Between 1914 and 1950 Convergence stopped because of policies of deglobalization and implosion into autarchy.

Bhargava (2008) concluded not only that literacy rates affect growth in a quadratic manner but also that countries presenting high literacy levels are more likely to have greater gains due to Globalization. The author also ended up dismissing Globalization measures, such as Foreign Direct Investment and Capital Flows because they were found not to be significant predictors of growth rates, poverty and inequality measures. Another finding was that Population health indicators were important predictors of growth, as well as being able to ascertain that poverty is not directly affected by Globalization indicators. Another finding of this paper was the fact that medium and high skilled labor work force had significant effects in the model for Gini coefficients, with high proportions of high skilled labor implying greater inequality.

In the end of the 1990's the model of development in East Asia broke down, showing it had vulnerabilities with the financial sector being one of the most vulnerable. Greenwood (2004) says that one of the greatest causes of pressure that lead the system to collapse was the increasing competition, both from the inside and the outside of the country The greater the competition does not allow for allowing complacency to anyone. As Greenwood says "Globalization means that new competitors, with a new set of comparative advantages are entering the international economic arena.". The author also blames corruption for it, as it scares off potential investors due to the unstable and uncertain climate. This in turn will crush entrepreneurship and lead to misallocation of factors of production.

Onwuka & Eguavoen (2007), consider that Globalization has benefited mainly developed countries, and this expansion was made at the cost of poorer countries enlarging the gap between developed and developing countries. Due to reasons like its monoculture exports, the inability of the country to attract FDI and its enormous debt, the authors claim Nigeria has not really fully committed to the Globalization process yet. Even though Nigeria has not truly benefited from Globalization, they consider this situation to be reversible. This might be achieved through the diversification of exports, the reduction of the country's debt and through greater cooperation with other countries. Nigeria also needs to be more resistant against the power of foreign capital.

Onwuka & Eguavoen (2007) also blame protectionism (e.g. tariffs of some developed economies) as another reason for the gap between developing and developed economies.

Another problem related with Globalization that does not allow this process to waste the gap between rich and poor countries are the measures taken by industrial countries to protect their own markets. This happens in particular in sectors of the economy in which developing countries have a comparative advantage, usually leading to losses due to those protective measures, but harming the most the developing countries.

According to the authors, a challenge Globalization faces is the concept of an inclusive global market. This would force developed countries to choose between a global market focused solely on profit or on bringing prosperity to every country. For the second one to work, instruments of global economic solidarity would be necessary. It would be necessary that industrialized nations were to open their markets and relieve the developing countries of their debt, as well as providing developing countries with more support.

Lawal (2006) considers Globalization to be a natural consequence of development. Since it is a process very focused on leading economies to a state of interconnectedness, the author considers that the African economy needs to be more open. At the same time, there are some measures that are needed in order for Africa to be able to take the best possible out of the Globalization process.

The importance of a clear economic strategy of the African continent is grave. It is necessary in order to make it easier to coordinate policies and to gain relevance and power in the boards of the IMF, World Bank and WTO. It is also necessary in order for Africa to to take part on the decisions made by these organizations. Despite the number of opportunities that Globalization creates towards the world development, those opportunities are not being taken by all in an equal fashion. The regions of the globe that adopted outward-oriented measures presented incredible growth (e.g. East Asia), while others (e.g. Africa and Latin America) were more inward-oriented due to policies adopted in the 1970's and 1980's, leading to an economic stagnation and to the decline of the socio-economic situation.

Olusi et al. (2006) concluded that the effect of trade openness on Economic Growth was positive, while the effect of financial integration on the economy on the other hand is negative. The author points corruption and the lack of full commitment to Globalization in the form of economic policies as two explanations for the negative effect of the financial integration on the Nigerian economy. Besides suggesting that the best thing for the country's future would be total integration, with the withdrawal of all barriers to trade and capital flows. Olusi et al. (2006) defend that Globalization is responsible for bringing inequality to the world, causing developed and developing countries to get even further apart economically and consequently in terms of living conditions. The authors consider that the way the liberalization of the markets was conducted might have compromised the possibilities of growth for the developing economies.

In his essay, Sapkota (2010) looks for convergence in human QOL (Quality of Life) levels in Asian countries, as well as the effect of Globalization on the trends of QOL. The author confirms that, for the Asian case, Globalization had indeed an important role in reducing the gap between rich and poor countries in terms of the quality of life. Despite the divergence verified in the GDP *per capita*, Globalization was not found to have a significant effect in this happening.

Dreher (2006) used panel data to study if the index of Globalization made with three main aspects, economic integration, social integration and political integration affect Globalization. The author concludes that Globalization leads to growth and the overall index of Globalization is highly significant and very robust. This leads the author to conclude that claims blaming the prevalence of poverty on Globalization are invalid.

Neto & Veiga (2008) prove in their work that the ratio between Foreign Direct Investment and Total Liabilities has a direct effect on growth, specifically through the speed of convergence. The results are in line with the neoclassical growth model, with developing countries gaining more due to its initial lower GDP.

According to Rourke (2001), the evidence concerning the between-country Divergence in the late 19 and 20th centuries is due to the different levels of technological progress rather than an effect of Globalization.

Figure 1 represents the Economic Growth for the period studied as the average of the GDP_{pc} (GDP *per capita*, PPP in current international $)) of all the countries studied (World), and also some sub groups divided by continents. It is easily observable that there has been an immense growth in most of the continents. However, in some continents, like Asia, economic growth has more than tripled, while in Africa it has only doubled. The gap between developing countries and developed countries in terms of average of GDP_{pc} is still enormous (e.g. the gap between Europe and Africa is greater than 30000.

Figure 1 – Evolution of Economic Growth (GDP_{pc} , PPP in Current international $)

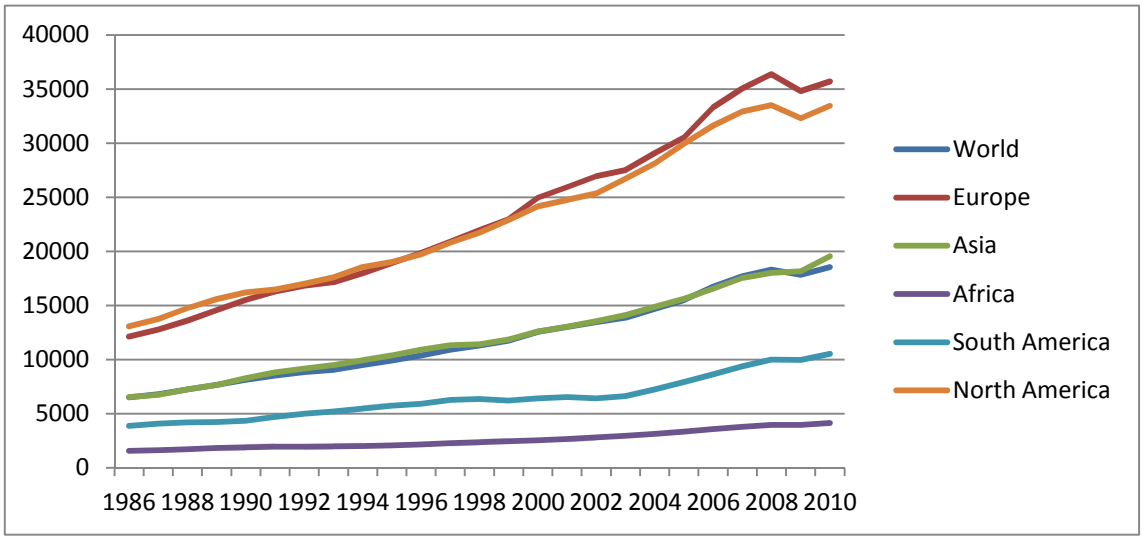


Figure 2 - Evolution of Openness (Trade in % of GDP)

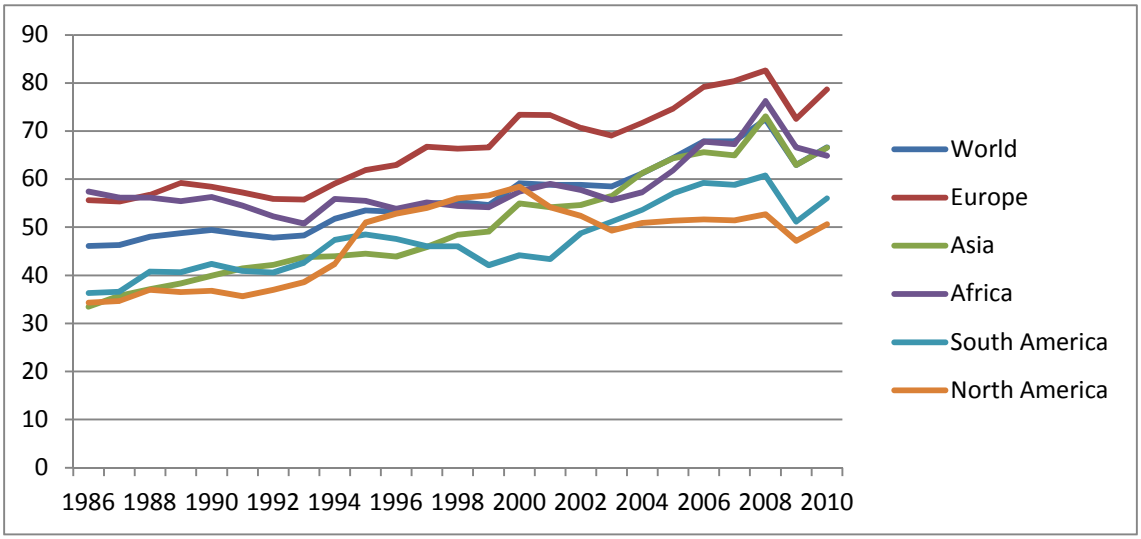


Figure 2 shows the Evolution of Trade measured as the percentage of the GDP[4]. I did this study in order to get a measure of the evolution of Globalization, using Trade as a proxy.

As it can be seen in Figure 2, the openness index in the groups of countries presented shows a clear growth trend, except for the period of the late 90's and the beginning of the 00's. In this period there was a slight drop in the levels of trade, but after that it grew again. The general trend in this period is of greater openness and Globalization. This path is visible at the regional or continental level, but also in the overall world.

4 The values for trade were taken from the World Bank, World Development Databases and represent the total of exports and imports, as a share of the country's GDP, in percentage.

Methodology and Data

a) Methodology

Convergence implies erosion in the gap between rich and poor countries, at least in percentage terms. When talking about beta-convergence, there are two types of convergence. Both Barro (1991) and Mankiw et al. (1992) conclude, through the models they tested when inserting in the Absolute Convergence model new explanatory variables like Human Capital, that led them to support the Conditional Convergence hypothesis instead of Absolute Convergence (Figueiredo et al. 2008). Even if convergence is unrelenting, if the initial gap was big, it will take a long time to erase.

If there is Absolute Beta-Convergence, economies will all tend to the same steady-state and the poorer economies grow faster than the richer economies (Barro, 1991). Absolute beta convergence is usually tested through an econometric equation such as equation 1 (Baumol, 1986).

$$\frac{1}{T} Ln\left(\frac{Y_{iT}}{Y_{i0}}\right) = \alpha + \beta Ln(Y_{i0}) + \mu_i \qquad (1)$$

Where Y represents the GDP of the nation, and therefore $Ln\left(\frac{Y_{iT}}{Y_0}\right)$ represents the growth in the GDP *per capita* of the nation i for the period of T years. If the estimated Beta parameter is both negative and statistically significant, then there is Absolute Beta convergence. This means there is convergence when there is a negative correlation between the initial *per capita* GDP and the growth rate for a given group of cross section data concerning countries or regions.

After estimating the models for Absolute Beta-Convergence and the values of the coefficient β, I will calculate the values of the rate or speed of convergence and of the half-life of convergence. To calculate the $\text{Speed of Convergence} = -\frac{\text{Ln}(1+\text{T}\beta)}{\text{T}}$ and to calculate the $\text{Half} - \text{Life of Convergence} = \frac{\text{Ln}(2)}{\text{Speed of Convergence}}$ (Jan & Chaudhary, 2011). The speed of convergence is simply the rate at which the countries are erasing the existing gap between them, essentially it gives the percentage of the initial gap between countries that is erased every year. The half-life of convergence represents the number of years required to erase half of the initial gap between the countries.

In the absence of evidence of Absolute Beta-Convergence, there might be Conditional Beta-Convergence. In Conditional Beta-Convergence, each economy converges to its own steady-state, with every economy having its particular steady-state level and growing faster the further it is from the steady-state (Barro & Sala-i-Martin, 1995).

If there is Conditional-Convergence the growth rate of an economy slows down when it is close to reach its steady state. Therefore there is a positive relation between the growth rate of an economy and its distance to the Steady State. Conditional Beta Convergence brings to the analysis the influence of the structural characteristics of the economies. When studying

conditional Beta-Convergence it is very frequent to use Dummy variables, in order to control the differences between the economies present in the sample.

The following equation will be the base for the study of the hypothesis of conditional convergence. This type of regression, fairly known as regressions a la Barro, is represented in Equation 2.

$$g_i = \propto o + \beta Y_{0i} + \gamma X_i + \mu_i \qquad (2)$$

where the dependent variable in the annual growth rate of real *per capita* GDP. X_i is the vector that represents the exogenous variables that have an impact on growth, the same principle used by Barro (1996).

Studying Convergence through Beta-Convergence is not considered adequate by some scholars, like Quah (1993) because of its exposure to distortions in the sample. Quah (1993) also points limitations when it comes to the use of standard cross-section regression when checking for convergence as, due to Galton's fallacy, the conclusions are sometimes misleading. This problems and limitations make some scholars prefer to study Sigma instead of Beta-Convergence as they find it more revealing.

Sigma-Convergence is present when the dispersion in the levels of GDP_{pc} of a group of economies or countries tends to diminish with time. Sigma Convergence is very simple to test, with a very intuitive and simple methodology, by calculating standard deviation, variation coefficient or dispersion coefficient.

Firstly I will study Sigma-Convergence, which is studied through the coefficient of variation, calculated as described in Equation 2.

$$\text{Coefficient of Variation} = \frac{\text{Standard Deviation}}{\text{Mean}} \qquad \mathbf{(3)}$$

I will calculate Sigma-Convergence concerning the variables GDP_{pc} and HDI. While studying Sigma-Convergence for the Human Development Index, I decided to do a similar study to the one conducted by Sapkota (2010), by analyzing the different components of this Index separately. I proceeded to do some dispersion statistics for the Education Index, Health Index, Income Index and also the Non-Income Index (Education and Health Index together) in order to look for Sigma-Convergence, calculated by the same formula of equation 3.

Secondly, I will estimate several Beta-Convergence models: absolute Beta-Convergence as well as Conditional Beta-Convergence models. These models are represented in the form of equations 4, 5, 6 and 7, respectively.

$$\frac{1}{T}\mathrm{Ln}\left(\frac{\mathrm{GDP}_{\mathrm{pc}_{i,T}}}{\mathrm{GDP}_{\mathrm{pc}_{i,o}}}\right) = \alpha + \beta_1 \mathrm{Ln}\left(\mathrm{GDPpc}_{i,o}\right) + \varepsilon_i, \varepsilon_i \rightarrow \mathrm{i.i.d}(o, \sigma_\varepsilon^2) \quad (4)$$

$$\frac{1}{T}\mathrm{Ln}\left(\frac{\mathrm{HDI}_{i,T}}{\mathrm{HDI}_{i,0}}\right) = \alpha + \beta_1 \mathrm{Ln}\left(\mathrm{HDI}_{i,o}\right) + \varepsilon_i, \varepsilon_i \rightarrow \mathrm{i.i.d}(o, \sigma_\varepsilon^2) \quad (5)$$

$$\frac{1}{T}\mathrm{Ln}\left(\frac{\mathrm{GDP}_{\mathrm{pc}_{i,T}}}{\mathrm{GDP}_{\mathrm{pc}_{i,o}}}\right) = \alpha + \beta_1 \mathrm{Ln}\left(\mathrm{GDPpc}_{i,0}\right) + \delta_1 D_1 + \delta_2 D_2 + \delta_3 D_3 + \delta_4 D_4 + \beta_2 \overline{H} + \beta_3 \overline{E} + \beta_4 \overline{I} + \beta_5 \overline{G} + \beta_6 \overline{R} + \varepsilon_i, \varepsilon_i \rightarrow \mathrm{i.i.d}(o, \sigma_\varepsilon^2) \quad (6)$$

$$\frac{1}{T}\mathrm{Ln}\left(\frac{\mathrm{HDI}_{i,T}}{\mathrm{HDI}_{i,0}}\right) = \alpha + \beta_1 \mathrm{Ln}\left(\mathrm{HDI}_{i,0}\right) + \delta_1 D_1 + \delta_2 D_2 + \delta_3 D_3 + \delta_4 D_4 + \beta_2 \overline{H} + \beta_3 \overline{E} + \beta_4 \overline{I} + \beta_5 \overline{G} + \beta_6 \overline{R} + \varepsilon_i, \varepsilon_i \rightarrow \mathrm{i.i.d}(o, \sigma_\varepsilon^2) \quad (7)$$

I used the same equation as Baumol (1986), in order to test for Absolute Beta-Convergence in GDP *per capita*, as it is presented in Equation 4. The left side of Equation 4 represents the average growth rate of the GDP_{pc} of the country I, for the studied interval, T. In Equation 4, $\mathrm{GDP}_{\mathrm{pc}_{i,T}}$ is the value of GDP_{pc} in the year T for the country I, $\ln\left(\mathrm{GDPpc}_{i,o}\right)$ is the log of GDPpc for the country I in the first year of the studied period and α is the constant.

The model in Equation 5 is very similar to the one represented in Equation 4, as it allows testing the same hypothesis of Absolute Beta-Convergence but now applied to HDI, instead of GDP_{pc}. In equation 5, $\mathrm{HDI}_{i,T}$ is the value of HDI in the year T for the country I and $\mathrm{HDI}_{i,o}$ is the initial value of HDI for the country I.

If, in the estimation of the models presented in Equations 4 and 5 there is a negative relation between the initial value of GDP_{pc} or initial HDI and the corresponding growth rate (GDP *per capita* or HDI correspondently), and this relation is statistically significant, Absolute Beta-Convergence is present.

Equation 6 is a model for Conditional Beta-Convergence, with the left side of the equation representing the average annual growth of GDP_{pc}. T stands for the interval being studied and i represents each country.

In both Equation 6 and Equation 7, $\overline{G}$ represents Globalization or the openness of the country's economy, measured by the average level of international trade for the period studied (Samuel, 2008). $\overline{H}$ represents the average level of Health in the period, $\overline{E}$ represents the level of Education, $\overline{I}$ represents the level of Foreign Direct Investment and finally, $\overline{R}$ represents the level of R&D.

In the Equations 6 and 7, the continental Dummies are represented by $D_1, D_2, D_3 \text{ and } D_4$. I used four Dummy variables for the five continents, as Bhargava (2008) when trying to look for conditional convergence. I decided to use continental Dummies, representing Europe, Africa, Asia (in which I inserted the countries from Oceania, as there were only two), South America and North America.

After estimating the models for conditional and Absolute Beta-Convergence in EViews, for both HDI and GDP_{pc}, I checked for heteroscedasticity using the White Test. The White Test tests the null hypothesis of no heteroscedasticity, meaning that if as a result of the test H_0 is rejected, the model is hetereoscedastic for a level of significance of 5%.

b) Data

The work of Solow was of outstanding importance for the current models of growth. Dynamics were brought to the Keynesian theory through the work developed by Harrod (1939) and Domar (1946). The classical school cannot be underestimated, with the idea that social and technical division of work brings sustained Economic Growth (Smith, 1977).

Mankiw et al. (1992) in their turn added Human Capital (used in the model as another production factor, represented by H_t^{β}, where Beta is the elasticity of the product relatively to the Human Capital and H is the stock of Human Capita l at time t, variable which relevance is vastly supported by empirical testing. As they tested Solow's Model using OLS and concluded that, even though some results were aligned with the empirical data, some of Solow's predictions were found to be inconsistent with the data, when it came to the share of capital in income, it was much higher than the 1/3 implied in the standard Solow Model.

The variables or indicators that I initially intended to analyze were related mainly with quality of life. As such, I will study several social variables, concerning environment, health, employment and Economic Development, but also variables concerning Economic Growth and the evolution of the economy. When choosing the variables, I tried to choose those that could be used as proxies for growth (like GDP and GDP *per capita*). Proxies that can be used to ascertain the level of openness (like Foreign Direct Investment (FDI), trade, exports and imports) as this is a way to see if a country is really dedicated and embracing the Globalization process, a usual practice as referred by Dreher (2006).

I chose the databases from the World Bank, particularly the World Development Indicators Databases, as they provided data for larger periods than the IMF databases and also had more variables than the ones available from the OECD. The period studied is the period from 1986 to 2010, which was the broader period possible, since it was the larger period of time with more variables and more data for the greatest amount of countries possible (http://www.worldbank.org/). There was a certain tradeoff between cross section data and time series data, in order to try and analyze the biggest sample possible. The countries that are going to be studied are from Asia, Africa, America Europe and Oceania, in a total of 39 countries As

such, our sample comprehends countries from all continents (except for Antarctica) and also countries from both the group of the developed countries and the developing group.

I used the World Bank databases for every variable except for the analysis related to the Human Development Index. The variable HDI was taken from the UNDP databases for the Human Development Index. HDI has three dimensions as mentioned before, Life expectancy, Educational Attainment and *per capita* Income. The amounts of resources allocated by each country on each component are not taken into account, which means that the different efficiencies of countries concerning the use of the resources they use is not considered. HDI is also very useful in socioeconomic analysis of cross-country development. A higher HDI usually means higher productivity as well as a greater number of opportunities in sectors like education, healthcare, etc., which also means that an higher HDI is usually associated to an higher income *per capita* (http://www.undp.org/content/undp/en/home.html).

When studying HDI, I used data gathered from the United Nations Development Programme (UNDP) databases for the Human Development Index, concerning the period between 1980 and 2012, for 46 different countries. Compared to the rest of the work, the analysis related to the HDI, comprehends more countries, in a total of 47. Guinea for example is not present due to lack of data available but countries like Algeria, Honduras, Greece, Honduras, Guatemala, Ghana, Ireland, Mozambique and Sudan are present despite not being present in the rest of the work. This happens simply because of the different availability of data in the different databases (World Bank and UNDP). The data was available for the years 1980, 1990, 2000 and 2005 to 2012.

In the exercises concerning the GDP *per capita*, I used data taken from the World Bank databases. When studying Sigma-Convergence for GD_{pc} I used data from the period between 1986 and 2010 and comprehending 51 countries. When studying Absolute and Conditional Beta-Convergence for GDP_{pc} however I used only 40 countries. I used the variable Gross Domestic Product *per capita*, GDP *per capita*, based on purchasing power parity PPP (current international $). GDP_{pc} is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current international dollars.

The variable presented in the model as $\overline{H}$ as a proxy for Health is Mortality rate, under-5. The variable Mortality rate, under-5 (per 1,000 live births) is the probability per 1,000 of a newborn baby to die before the age of five is reached, if subject to current age-specific mortality rates.

I used the variable School enrollment, tertiary (% gross) as proxy for Education, represented in the model by $\overline{E}$. School Enrollment Tertiary represents the gross enrolment ratio and is given by the percentage of the total population of the five-year age group following on

from secondary school leaving, enrolled in tertiary education (International Standard Classification of Education (ISCED) levels 5 and 6), regardless of age.

The variable Foreign Direct Investment, net (Balance of Payments (BoP), current US$), is represented in the models by $\bar{I}$, taken from the World Bank Databases and measured in current U.S. Dollars (US$). Foreign Direct Investment consists of the net inflows of investment to obtain a durable management interest (at least 10% of the voting stock) in an enterprise operating in an economy different from the investor's. The Foreign Direct Investment results from the sum of several elements: equity capital, reinvestment of earnings and other long-term and short-term capital as shown in the balance of payments (BoP). This series shows total net, which is given by the difference between the net FDI in the reporting economy from foreign sources and the net FDI by the reporting economy to the rest of the world.

For the explanatory variable $\bar{G}$, representing Globalization, the variable Trade in percentage of the GDP was used as a proxy. The variable Trade was extracted from the World Bank Databases and comes from the sum of export and import as a share of the GDP.

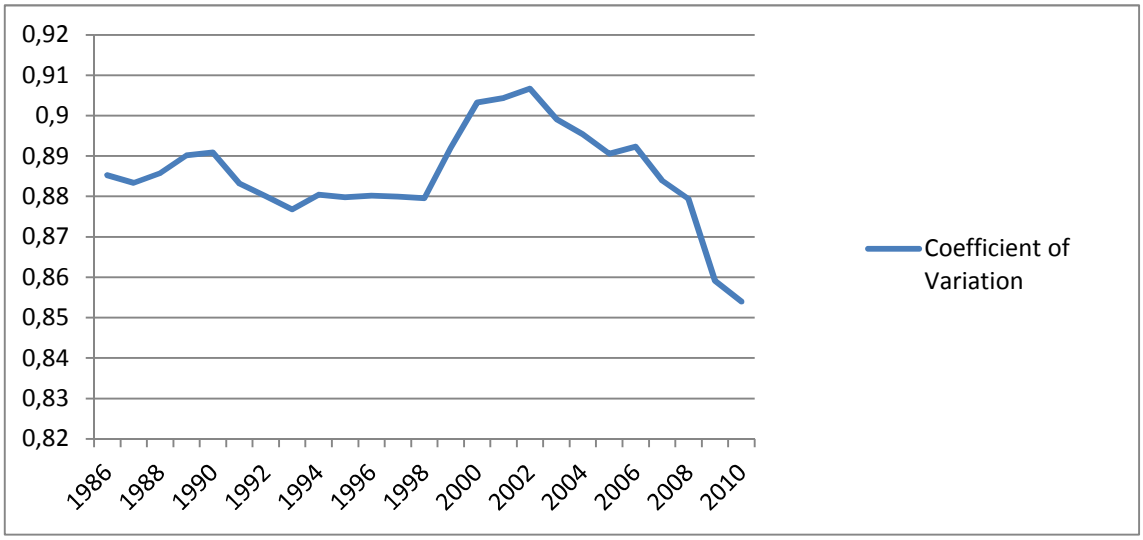
Scientific and technical journal articles, represented in the model by $\bar{R}$, was used as a proxy for R&D. Scientific and technical journal articles refers to the number of scientific and engineering articles published in several areas (physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences) and was then turned into *per capita*, to be balanced, by dividing it by the number of people of each country.

Results

a) Sigma Convergence

Figure 3 results from the study of the Hypothesis of Sigma-Convergence for GDPpc. As it is observable in Figure 3, there is a raise from 1988 to 1990, followed by a decline after 1990, growing again after 1995. After that, the coefficient of variation diminishes, just to start growing from 1998 to 2002, just to plummet after 2002 until the end of the studied period, 2010, with a fall of over 0.05. Even though it is clear that Sigma-Convergence is not a trend throughout all of the studied period, it is for most of it, and it is the clear, steady trend in the last 8 years studied.

Figure 3 – Sigma-Convergence for GDP_{pc} (measured in PPP, in current international $)



By checking, in Figure 4, the values of the coefficient of variation of the group of countries, for the level of Human Development Index in the period studied, I conclude that there is Sigma-Convergence. There is Sigma-Convergence, since the coefficient of variation for the studied countries diminishes throughout time, meaning the dispersion in the values of HDI is decreasing.

Figure 4 - Sigma-Convergence for HDI

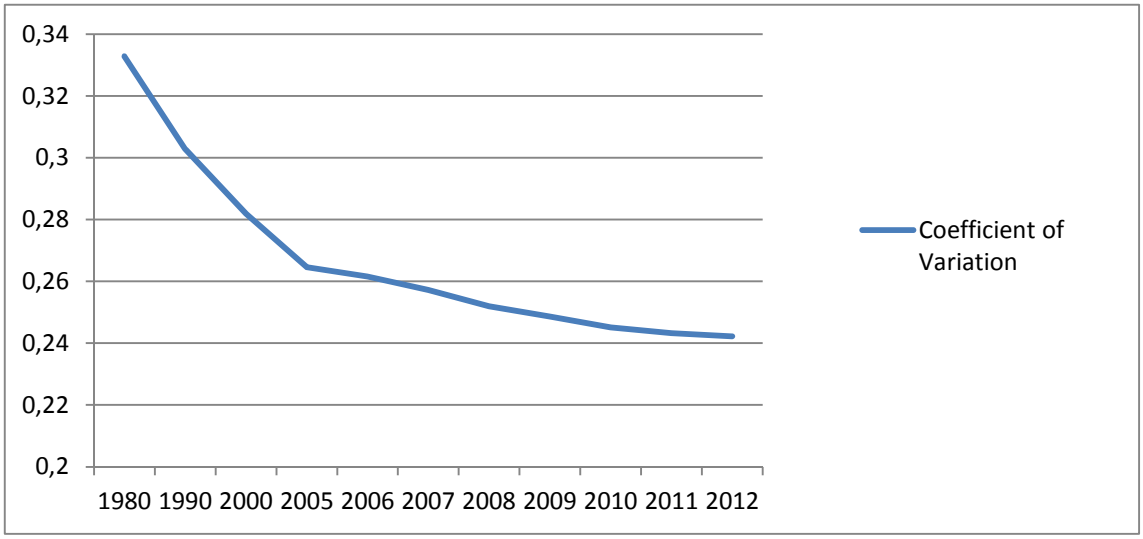
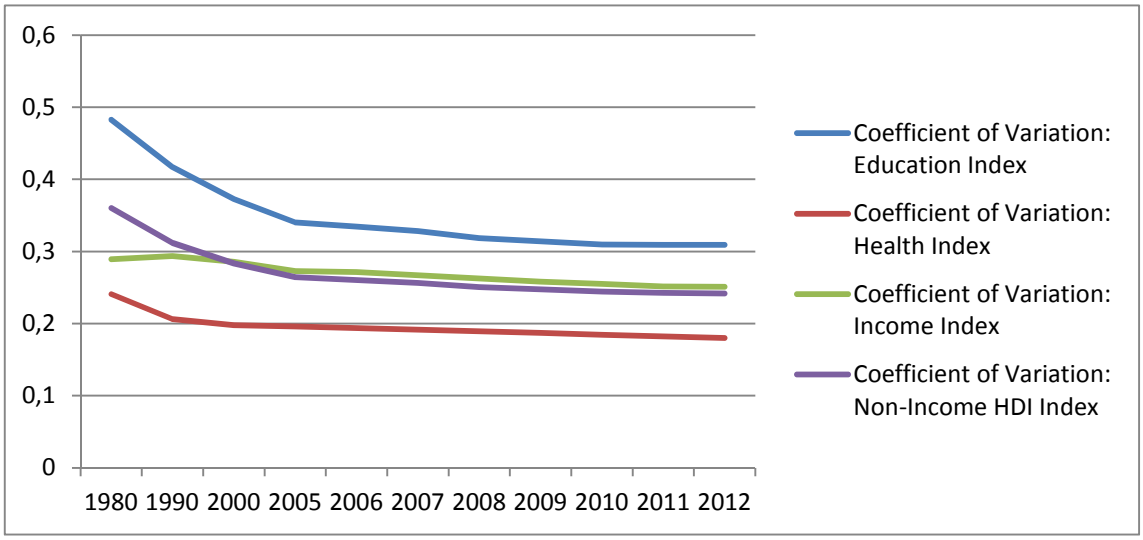


Figure 5 represents the coefficient of variation for the different dimensions of the HDI (Education, Health and Income and the first two together, in what I called the Non-Income HDI Index), I found that there are clear signs of Sigma-Convergence for all dimensions of the HDI analyzed. As it is observable in Figure 5, the coefficient of variation keeps falling through the studied period of time.

There is an exception to this trend, as the Income Index shows slight divergence from 1980 to 1990, just to go back to showing signs of Convergence for the rest of the period, with its coefficient of variation falling with time. It is also possible to observe that, from the three different dimensions, the Education Index is clearly the one that shows greater Sigma-Convergence, meaning it is the dimension of the HDI that brings a greater contribution to the Sigma-Convergence observed in the period studied.

Figure 5 - Sigma-Convergence for HDI individual Dimensions



b) Absolute-Beta Convergence

Table 1 represents the results of the estimation of the model of Absolute Beta-Convergence for GDP_{pc} represented before in Equation 4. Absolute Beta-Convergence implies a negative value for the coefficient β. The results do not allow the rejection of the null hypothesis, since, as it is observable in the Table 1, the P-Value of (0.1899) is higher than 0.05 and therefore, the hypothesis H_0: $\beta_1=0$ cannot be rejected with 5% significance, this means there is no Absolute Beta-Convergence in the period and countries studied.

Table 1 – Absolute Beta-Convergence for GDP_{pc}

Dependent Variable: $\frac{1}{T}\text{Ln}\left(\frac{\text{GDP}_{\text{pc}_{i,T}}}{\text{GDP}_{\text{pc}_{i,o}}}\right)$
Method: Least Squares
Sample: 1 39
Included observations: 39

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\ln(\text{GDPpc}_{i,o})$	-0.003257	0.002439	-1.335541	0.1899
C	0.072585	0.020767	3.495246	0.0012

R-squared	0.045990	Mean dependent var	0.045082
Adjusted R-squared	0.020206	S.D. dependent var	0.016918
S.E. of regression	0.016746	Akaike info criterion	-5.291354
Sum squared resid	0.010376	Schwarz criterion	-5.206043
Log likelihood	105.1814	Hannan-Quinn criter.	-5.260745
F-statistic	1.783671	Durbin-Watson stat	2.097954
Prob(F-statistic)	0.189857		

Source - Own Calculation

Table 2 shows the estimation on EViews of the simple linear regression represented in Equation 5, in order to check for Absolute Beta-Convergence in HDI, similarly to what I had done for GDP_{pc}. By looking at Table 2, it is possible to realize that, when it comes to the values of HDI for the countries under analysis, there is Absolute Beta-Convergence for the period studied. I can conclude this because the coefficient of the starting point of HDI is negatively related to its growth as the sign of the estimated parameter for the exogenous variable is negative (-0.010451), and it is statistically significant for a level of significance of 5%, as the P-value of (0.0000) for the coefficients of the exogenous variable is smaller than 0.05.

Table 2 – Absolute Beta-Convergence for HDI

Dependent Variable: $\frac{1}{T}\text{Ln}\left(\frac{HDI_{i,T}}{HDI_{i,o}}\right)$
Method: Least Squares
Sample: 1 39
Included observations: 39
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\ln(HDI_{i,o})$	-0.010451	0.001035	-10.10010	0.0000
C	0.002523	0.000503	5.020454	0.0000

R-squared	0.775666	Mean dependent var	0.008590
Adjusted R-squared	0.769603	S.D. dependent var	0.004584
S.E. of regression	0.002200	Akaike info criterion	-9.350374
Sum squared resid	0.000179	Schwarz criterion	-9.265063
Log likelihood	184.3323	Hannan-Quinn criter.	-9.319765
F-statistic	127.9325	Durbin-Watson stat	1.756845
Prob(F-statistic)	0.000000		

Source - Own Calculation

Initially I estimated the model of Absolute Beta-Convergence for GDP *per capita* and checked it for Heteroscedasticity. I found signs of Heteroscedasticity and this leads to the OLS estimators no longer being efficient. As such, the model presented in Table 2 results from the estimation of the model using a robust method, known as White's Heteroscedasticity-Consistent Covariances and standard errors in order to validate statistic inference.

The average annual speed of Convergence in this case is of 0.012722 or 1.2722% and the half-life of Convergence is of 54.48274 years. This means that, at this rate, it will take 55 years for half of the current gap among countries to be eroded. I estimated these values in the exercise of Absolute Beta-Convergence for HDI but not when it came to GDP_{pc}, because the last one did not show signs of Convergence, since the model did not prove to be significant.

c) Conditional-Beta Convergence

Table 3 shows the estimation of the model previously represented in Equation 6, of Conditional Beta-Convergence for GDP_{pc}. By observing Table 3, and checking the value of P-Value (0.000002) for the (F-Statistic) I can conclude, through the overall significance test, that the model was globally significant. The model is globally significant since the value for Prob(F-Statistic) is smaller than 5%=0.05, which means I can reject, with 95% confidence, the null hypothesis H_0: $\beta_1=\delta_1=\delta_2=\delta_3=\delta_4=\beta_2=\beta_3=\beta_4=\beta_5=\beta_6=0$.

Continuing the analysis of Table 3, more specifically the P-Values of the coefficients for each explanatory variable, I can conclude which variables were statistically significant, for a 5% level of significance. The variables were the initial level of GDP *per capita*, the Mortality Rate Under-5, the Foreign Direct Investment, Net and the Dummy for South America.

The estimated coefficient exogenous variable Mortality Rate, under-5 also has a negative sign, and its estimated value is -0.000310, which means that a raise of one unit in the value of Mortality Rate, under-5 causes, if everything else remains constant, an average fall of 0.000310 in the growth of GDP_{pc} in the period. The other significant explanatory variable is the Foreign Direct Investment, Net, which has an estimated coefficient of 0.003871. This means that, when Foreign Direct Investment, Net raises in 1US$, the average annual growth of GDP_{pc} will rise by 0.003871. The continental Dummy for South America, (D_4) is significant and its coefficient has a negative sign, and an estimated value of -0.020136. This means that countries from South America grew, in average, less 0.02 than the average, if everything else remains constant.

Table 3 – Conditional Beta-Convergence for GDP_{pc}

Dependent Variable: $\frac{1}{T}\text{Ln}\left(\frac{\text{GDP}_{\text{pc}_{i,T}}}{\text{GDP}_{\text{pc}_{i,o}}}\right)$
Method: Least Squares
Sample: 1 39
Included observations: 39

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\ln(\text{GDPpc}_{i,o})$	-0.019606	0.003862	-5.077207	0.0000
AFRICA (D_1)	-0.009657	0.009139	-1.056661	0.2997
ASIA (D_2)	0.001024	0.007305	0.140161	0.8895
EUROPE (D_3)	0.002728	0.006917	0.394304	0.6963
SOUTHAMERICA (D_4)	-0.020136	0.008200	-2.455415	0.0205
Mortality rate, under-5 (per 1,000 live births)	-0.000310	6.47E-05	-4.792915	0.0000
School enrollment, tertiary (% gross)	0.000139	0.000163	0.849009	0.4031
Foreign direct investment, net (BoP, current US$)	0.003871	0.001727	2.241040	0.0331
Trade (% of GDP)	-6.06E-05	8.76E-05	-0.691804	0.4948
Scientific and technical journal articles *per capita*	-7.352542	9.306831	-0.790016	0.4362
C	0.221244	0.034261	6.457575	0.0000

R-squared	0.762786	Mean dependent var	0.045082
Adjusted R-squared	0.678066	S.D. dependent var	0.016918
S.E. of regression	0.009599	Akaike info criterion	-6.221525
Sum squared resid	0.002580	Schwarz criterion	-5.752315
Log likelihood	132.3197	Hannan-Quinn criter.	-6.053177
F-statistic	9.003672	Durbin-Watson stat	2.106530
Prob(F-statistic)	0.000002		

Source - Own Calculation

The rest of the variables turned out to be insignificant considering a significance level of 5%. Finally, I can conclude by observing the Table 3, that there is Conditional Beta-Convergence for GDP_{pc} for the period and countries studied, as the P-value of the t test for β_1 is statistically significant, for a level of significance of 5% (0.0000<0.05) and the sign of the estimated parameter is negative.

Table 4 shows the results of estimating the model concerning Conditional Beta-Convergence for HDI, represented in the Equation 7. By observing Table 4, I concluded that the model is globally significant, according to the overall significance test, as the P-value is 0.000000<0.05. Table 4 shows the output for the model of Conditional Beta-Convergence, which shows that, for the period and countries studied, there is convergence of this type. There is Conditional Beta-Convergence in this case as the estimated β_1 has a negative signal (-0.021171) and it is also statistically significant for a 95% level of confidence, since the P-Value (0.0000) of its t test is lower than 0.05.

Table 4 - Conditional Beta-Convergence for HDI

Dependent Variable: $\frac{1}{T}\text{Ln}\left(\frac{HDI_{i,T}}{HDI_{i,o}}\right)$
Method: Least Squares
Sample: 1 39
Included observations: 39

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\ln(HDI_{i,o})$	-0.021171	0.002213	-9.568534	0.0000
AFRICA (D_1)	-0.001534	0.001346	-1.139583	0.2641
ASIA (D_2)	0.000368	0.001083	0.339683	0.7366
EUROPE (D_3)	0.000615	0.000995	0.617920	0.5416
SOUTHAMERICA (D_4)	-0.001602	0.001233	-1.299089	0.2045
Mortality rate, under-5 (per 1,000 live births)	-6.48E-05	1.35E-05	-4.797395	0.0000
School enrollment, tertiary (% gross)	2.66E-05	2.41E-05	1.102490	0.2796
Foreign direct investment, net (BoP, current US$)	0.000342	0.000248	1.378190	0.1791
Trade (% of GDP)	-1.98E-05	1.30E-05	-1.524653	0.1386
Scientific and technical journal articles *per capita*	-1.004877	1.362578	-0.737482	0.4670
C	-0.000823	0.001833	-0.448815	0.6570

R-squared	0.928008	Mean dependent var	0.008590
Adjusted R-squared	0.902297	S.D. dependent var	0.004584
S.E. of regression	0.001433	Akaike info criterion	-10.02542
Sum squared resid	5.75E-05	Schwarz criterion	-9.556211
Log likelihood	206.4957	Hannan-Quinn criter.	-9.857072
F-statistic	36.09335	Durbin-Watson stat	1.973286
Prob(F-statistic)	0.000000		

Source - Own Calculation

By looking at the values of P-values of the coefficients of the explanatory variables, I concluded that the only statistically significant is the variable Mortality Rate, under-5, for a level of 5% significance, as the P-Value (0.0000) is smaller than 0.05. The variable Mortality Rate, under-5 is statistically significant and has a negative sign, with an estimated coefficient of -6.48E-05, which means that a raise of one unit of the variable Mortality Rate, under-5 leads to an average drop in the growth of the HDI by 6.48E-05, if everything else remains constant.

The Tables 5 and 6, presented in the Appendixes are the result from doing the White Test in order to check for Heteroscedasticity. I checked for Heteroscedasticity in both Conditional Beta-Convergence Models. By observing the tables in the parts concerning the White Test, I concluded, for a level of 5% significance, that there were no signs of Heteroskedasticity in the tables 5 and 6.

This is possible to conclude since, in each case, the value of the Prob F for the White Test was bigger than 0.05. In Table 5, Prob F(10.28)= 0.332759 and Prob F(10.28)=0.412407 in Table 6, meaning the null hypothesis of Homoscedasticity should not be rejected for a 5% significance level.

Conclusion

There is an old debate over Globalization and its effects. This debate concerns not only Economic Growth but also Economic Development in the economies of both developed and especially developing countries. Another controversial point when it comes to Globalization is its role in convergence. One last controversy concerning Globalization and Convergence has to do with the lack of consensus in the measures as a proxy that should be used when studying this subject. Some scholars defend the use of the Gross Domestic Product, while other scholars defend the use of other measures of Economic Development including other variables related to health, education and other well being related variables.

In this work I used both GDP and also measures of Economic Development. More specifically, I used the Human Development Index (HDI). The results of this study, particularly those related to convergence, some more aligned with literature and other less, confirm the controversial aspects of this issue and raise more research work.

Our first exercise focused on sigma convergence successively applied to GDP *per capita* and HDI. The first exercise for GDP_{pc} shows a Sigma-Convergence process, considering the all period. However, the process is not monotonous. There is an initial period of stability, between 1986 and 1998, followed by a period of clear Sigma-Divergence between 1998 and 2002 and finally, between 2002 and 2010 there is strong Sigma-Convergence, with the final level, in 2010, substantially below the value in 1986.

The exercises of Sigma-Convergence concerning the Human Development Index and its individual dimensions states that there is evidence of Sigma-Convergence. Concerning the Sigma-Convergence of the individual components of this indicator, there is also convergence, with the main responsible amongst its individual indexes being the Education dimension. This means that, during the studied period, there was, globally, convergence not only for GDP_{pc} but also for the rest of the well being variables related to Development. Furthermore, the variables related to Economic Development present a more consistent Sigma-Convergence process when compared to the one presented by GDP_{pc}. In conclusion, even though the distribution of wealth was not as great as it could have been expected, there was transfer of well being and development, namely in terms of human capital (education and health).

The results of the exercise of Absolute Beta-Convergence are contradictory. When applied to the GDP_{pc}, the results do not confirm the hypothesis of Absolute Beta-Convergence, which means that the poorer countries in the starting point do not grow faster than the richer countries. Absolute Beta-Convergence, despite being a necessary condition for Sigma-Convergence, is not sufficient condition. According to the literature on this subject, there can also be Absolute Beta-Convergence but no Sigma-Convergence due to random shocks pushing the economies apart. The results I obtained are not in accordance with the existing literature on the subject. This might open the opportunity to, in a future study, try to understand why this happens, and what might have caused it.

Differently, the results found evidence of Absolute Beta-Convergence concerning Economic Development (HDI). In this case the results are not as controversial, since there is both Absolute Beta-Convergence and Sigma-Convergence. Countries with lower initial levels of development managed to get closer to the countries that initially had higher levels of development, erasing some of the initial gap among the two groups of countries.

The exercises concerning Conditional Beta-Convergence for GDP_{pc} showed that, for the period and countries studied there is evidence of Conditional Beta-Convergence with three different explanatory variables used in the model proving to be significant. Those variables were Mortality Rate Under-5, Foreign Direct Investment and the continental Dummy for South America. This means that there are structural elements that prevent poor countries from growing to the level of richer countries. Variables concerning Health and Foreign Investment suggest that the poorer countries should open their economies even more to Globalization. I could not however find evidence of Absolute Beta Convergence for the growth of GDP_{pc}.

In the similar exercise for the Human Development Index, it was also found evidence of Conditional Beta-Convergence. However it is still clear that there is a very considerable gap between poor and rich countries, when it comes to the values of HDI. Unlike in the model for GDP_{pc}, in this model there are not as many statistically significant explanatory variables, only the variable Mortality Rate Under-5 is statistically significant.

These results confirm the controversy surrounding this subject and raise several possible new lines of investigation. Rogoff (2006) also as an interesting approach as the author studies the effects of Globalization on monetary policies, which are concluded to have been very positive. Such an approach may prove interesting to forecast some future problems and the solutions for those said problems and might be an interesting aid when studying the impact of the action of certain pro-Globalization groups and organizations on Convergence.

Analyzing the interventions of the IMF, WTO and World Bank and their role concerning Globalization, as well as the impact of their interventions in terms of Economic Development can be a very interesting future work. Some authors, like Drezner (2001) have already approached the importance, work and some of the controversial points concerning WTO its actions and its way of functioning.

In the future, another different approach that might be interesting is to do a similar study to the one made by Rourke (2001), and study within-country convergence instead of or as a complement for between-country convergence, in order to study the effects of Globalization in the Convergence trends and check if Within-Country patterns of convergence are similar to Between-Country. Finally, a possible line of future investigation is to, instead of using cross-country data to do the Convergence exercises, use panel data, as it becomes more common among Convergence studies.

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Annexes

Table 5 – White test for the Model of Conditional Beta-Convergence for GDPpc (White Cross Terms not included)

Heteroskedasticity Test: White

F-statistic	1.199823	Prob. F(10,28)	0.3328
Obs*R-squared	11.69879	Prob. Chi-Square(10)	0.3057
Scaled explained SS	6.875771	Prob. Chi-Square(10)	0.7371

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 1 39
Included observations: 39

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000116	0.000151	0.767487	0.4492
$[\ln(\mathrm{GDPpc}_{i,o})]$^2	-1.91E-06	2.00E-06	-0.955864	0.3473
[AFRICA (D_1)]^2	0.000122	9.28E-05	1.319243	0.1978
[ASIA (D_2)]^2	1.45E-05	7.89E-05	0.183894	0.8554
[EUROPE (D_3)]^2	1.00E-05	7.86E-05	0.127708	0.8993
[SOUTHAMERICA (D_4)]^2	-6.98E-06	8.43E-05	-0.082747	0.9346
[Mortality rate, under-5 (per 1,000 live births)]^2	-2.03E-09	2.04E-09	-0.995580	0.3280
[School enrollment, tertiary (% gross)]^2	2.55E-08	1.95E-08	1.306482	0.2020
[Foreign direct investment, net (BoP, current US$)]^2	-3.83E-07	3.15E-06	-0.121430	0.9042
[Trade (% of GDP)]^2	1.08E-08	6.51E-09	1.660819	0.1079
[Scientific and technical journal articles *per capita*]^2	-58.66130	58.61488	-1.000792	0.3255

R-squared	0.299969	Mean dependent var	6.62E-05
Adjusted R-squared	0.049958	S.D. dependent var	0.000101
S.E. of regression	9.86E-05	Akaike info criterion	-15.37728
Sum squared resid	2.72E-07	Schwarz criterion	-14.90807
Log likelihood	310.8570	Hannan-Quinn criter.	-15.20893
F-statistic	1.199823	Durbin-Watson stat	1.926279
Prob(F-statistic)	0.332759		

Table 6 - White test for the Model of Conditional Beta-Convergence for HDI (White Cross Terms not included)

Heteroskedasticity Test: White

F-statistic	1.075478	Prob. F(10,28)	0.4124
Obs*R-squared	10.82283	Prob. Chi-Square(10)	0.3715
Scaled explained SS	4.268720	Prob. Chi-Square(10)	0.9344

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 1 39
Included observations: 39

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.22E-07	1.70E-06	-0.365410	0.7176
$[\ln(\mathrm{HDI}_{i,o})]$^2	2.01E-06	1.82E-06	1.107329	0.2776
[AFRICA (D_1)]^2	7.21E-07	1.72E-06	0.418860	0.6785
[ASIA (D_2)]^2	1.37E-06	1.46E-06	0.936326	0.3571
[EUROPE (D_3)]^2	4.34E-07	1.39E-06	0.312914	0.7567
[SOUTHAMERICA (D_4)]^2	1.61E-06	1.57E-06	1.025066	0.3141
[Mortality rate, under-5 (per 1,000 live births)]^2	-5.55E-11	9.05E-11	-0.614026	0.5442
[School enrollment, tertiary (% gross)]^2	2.69E-10	3.41E-10	0.786968	0.4379
[Foreign direct investment, net (BoP, current US$)]^2	-4.82E-08	5.86E-08	-0.823111	0.4174
[Trade (% of GDP)]^2	1.36E-10	1.20E-10	1.130846	0.2677
[Scientific and technical journal articles *per capita*]^2	-0.809485	1.086583	-0.744983	0.4625

R-squared	0.277509	Mean dependent var	1.47E-06
Adjusted R-squared	0.019476	S.D. dependent var	1.85E-06
S.E. of regression	1.83E-06	Akaike info criterion	-23.35235
Sum squared resid	9.37E-11	Schwarz criterion	-22.88314
Log likelihood	466.3709	Hannan-Quinn criter.	-23.18401
F-statistic	1.075478	Durbin-Watson stat	2.419640
Prob(F-statistic)	0.412407		